

AMENDMENTS TO THE CLAIMS

The following listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) A copper alloy for welding electrodes, ~~characterized in that~~wherein the copper alloy contains, as a second element, which ~~that~~ does not dissolve or scarcely dissolves in copper in a solid solution state at room temperature, said second element being selected from the group consisting of any of chromium (Cr), zirconium (Zr), beryllium (Be), titanium (Ti) and boron (B), the respective addition ratios of the second ~~elements~~element being Cr: 0.1 to 1.4 wt%, Zr: 0.15 to 0.5 wt%, Be: 0.1 to 3.0 wt%, Ti: 0.1 to 6.0 wt%, B: 0.01 to 0.5 wt%, ~~in that~~ this and wherein the alloy has an average crystal grain size of not more than 20 μm , ~~in that~~ the second ~~elements~~element precipitates among crystal grains, and ~~in that~~ the copper alloy has a hardness of not less than 30 HRB, an electrical conductivity of not less than 85 IACS%, and a thermal conductivity of not less than 350 W/(m·K).

2. (Cancelled)

3. (Cancelled)

4. (Cancelled)

5. (Currently Amended) A method of manufacturing a copper alloy for welding electrodes, comprising the steps of:

~~characterized in that the method comprises enabling~~ any of chromium (Cr), zirconium (Zr), beryllium (Be), titanium (Ti) and boron (B) to dissolve in a solid solution in a base-material metal (Cu) as a second element that does not dissolve or scarcely dissolves in copper in a solid solution state at room temperature, the wherein respective addition ratios of the second elements-element being Cr: 0.1 to 1.4 wt%, Zr: 0.15 to 0.5 wt%, Be: 0.1 to 3.0 wt%, Ti: 0.1 to 6.0 wt%, B: 0.01 to 0.5 wt%,

~~subsequently achieving crystal grain refinement by applying a strain equivalent to an elongation of not less than 200% to this material~~ to achieve crystal grain refinement, and

~~subjecting this material to aging treatment simultaneously with or after the subsequent to application of this strain, thereby to promote promoting~~ precipitation of the second element among crystal grains.

6. (Cancelled)

7. (Currently Amended) The method of manufacturing a copper alloy for welding electrodes according to claim 5, ~~characterized in that means for applying a strain to the material~~ strain is applied to the material by ~~is any of extrusion~~ extruding, drawing, shearing, rolling and forging.

8. (Currently Amended) The method of manufacturing a copper alloy for welding

electrodes according to claim 7, ~~characterized in that conditions for the extrusion wherein strain is applied by extruding the material, and extrusion conditions~~ are such that lateral extrusion is performed at a material temperature of 400 to 1,000°C, a die temperature of 400 to 500°C, and an extrusion speed of 0.5 to 2.0 mm/sec.

9. (Currently Amended) The method of manufacturing a copper alloy for welding electrodes according to ~~any of claims 5, 7 or 8, characterized in that~~ claim 5, wherein the material is subjected to aging treatment before a strain is applied to the material, ~~the material is subjected to aging treatment beforehand.~~

10. (Currently Amended) A composite copper material for welding electrodes, ~~characterized in that~~ wherein an alumina powder or a titanium boride powder is dispersed in a copper matrix in an amount of 0.1 to 5.0 wt%, ~~said and in that this composite copper material has a hardness of at least not less than 30 HRB, an electrical conductivity of not less than at least 85 IACS%, and a thermal conductivity of not less than at least 350 W/(m·K).~~

11. (Cancelled)

12. (Cancelled)

13. (Cancelled)

14. (Currently Amended) A method of manufacturing a composite copper

material, comprising the steps of:

mixing ~~that comprises mixing~~ a copper powder and a ceramic powder together to

forming, ~~thereby to form~~ a mixed powder as a primary shaped body, and

applying a strain to said ~~this~~ primary shaped body, ~~thereby~~ to form a secondary shaped body in which base material and ceramic particles are combined together with refined particle sizes,

wherein ~~characterized in that the~~ an average particle size of the ceramic powder is

between about 0.3 to 10 μm , ~~in that at the~~ strain applied to the primary shaped body

is equivalent to an elongation of not less than 200%, ~~in that the means for the strain~~

is applied by extruding the primary shaped body ~~applying a strain is extrusion that is~~

performed at a material temperature of not less than 400°C but not more than

1,000°C and a die temperature of not less than 400°C but not more than 500°C, ~~in~~

~~that the~~ wherein an average particle size of a base material of the secondary shaped

body to be obtained is not more than 20 μm , and ~~in that the~~ average particle size of

ceramic particles is not more than 500 nm.

15. (Cancelled)

16. (Currently Amended) The method of manufacturing a composite copper material according to claim 14, ~~characterized in that~~ wherein the primary shaped body is obtained by green compacting or by filling the mixed powder in a tube.

17. (Cancelled)

18. (Currently Amended) A method of manufacturing a composite copper material in which titanium boride is dispersed in a copper matrix, ~~characterized in that the method comprises~~comprising the steps [1] to [3] ~~below~~of:

[1] ~~the step of~~ mixing a copper powder, a titanium powder and a boron powder together, ~~thereby~~ to form a primary shaped body;

[2] ~~the step of~~ applying thermal energy to the primary shaped body, ~~and~~ thereby causing the titanium powder and the boron powder to react with each other in order to form titanium boride in a ~~the~~ copper matrix; and

[3] ~~the step of~~ applying a strain to the primary shaped body, in which the titanium boride is formed, by plastically deforming the primary shaped body, ~~and~~ thereby ~~to form~~ forming a secondary shaped body.

19. (Currently Amended) The method of manufacturing a composite copper material according to claim 18, ~~characterized in that~~ wherein the secondary shaped body is subjected to heat treatment while ~~in the same step as the step of applying a~~ the strain by plastic deformation or a step following this step or following application of the strain.

20. (Currently Amended) The method of manufacturing a composite copper material according to claim 18, wherein ~~or 19, characterized in that the plastic deformation involves applying a strain equivalent to an elongation of not less than 200%.~~

21. (Currently Amended) The method of manufacturing a composite copper

material according to ~~any of claims 18 to 20, characterized in that~~ claim 18, wherein the plastic deformation is extrusion that is performed at a material temperature of not less than 400°C but not more than 1000°C.

22. (Currently Amended) The method of manufacturing a composite copper material according to ~~any of claims 18 to 20, characterized in that~~ claim 18, wherein the plastic deformation is extrusion that is performed at a die temperature of not less than 400°C but not more than 500°C.

23. (Currently Amended) The method of manufacturing a composite copper material according to ~~any of claims 18 to 22, characterized in that~~ claim 18, wherein the primary shaped body is obtained by green compacting or by filling a mixed powder in a tube.

24. (Currently Amended) The method of manufacturing a composite copper material according to ~~any of claims 18 to 23, characterized in that~~ claim 18, wherein the an average particle size of the ceramic powder is 0.3 to 10 μm , ~~in that the~~ an average particle size of a base material of the secondary shaped body to be obtained is not more than 20 μm , and ~~in that the~~ an average particle size of titanium boride particles is not more than 500 nm.